REMARKS

1. Claim 13 is canceled.

5. Claim 2 is canceled; Claim 12 is amended per objection in Par. 5 of the Office Action.

7. The Applicant believes that the objection stated in Par. 7 of the Office Action is removed by the "Amendment to Specification".

10. Claims 10, 11, 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Werdich, U.S. 4,966,386.

Werdich teaches (col. 4, lines 4-15) biasing of the disclosed torsion spring in torsional direction which results in changing the degree of "squeezing" of rubber elements 4, as it is obvious from Fig. 1 of '386.

Claim 10 of the instant Application teaches preloading of the streamlined rubber elements of the proposed bushing in (radial) compression. Not only this mode of preloading is radically different from the one described in '386, but it is known in the art that the radial compression of the streamlined rubber elements allows changing their stiffness in a broad range while creating relatively low and uniform stresses/strains. On the other hand, squeezing of the rubber cylinder as disclosed in '386 drastically distorts its outline thus obviously creating intense stress/strain concentrations and greatly reducing its service life.

11. Claims 10, 11, 12 are also rejected under 35 U.S.C. 102(b) as being anticipated by Schwerdt, U.S. 5,096,166 with a specific reference to col. 1, lines 54-65 of '166. Applicant respectively submits that elements 9, 11 in '166 are not streamlined since they are constructed two components (elements 1, 2 in the upper parts of Figs. 1, 2 from '166) or four components (elements 9, 11 in the lower part of Fig. 1 from '166). These elements 9 and 11 are fillers of the respective cavities of sleeve springs disclosed in '166, said sleeve springs having no means for preloading fillers 9, 11. Accordingly, preloading of elastomeric elements 9, 11 is not mentioned in the cited lines 54-65, col. 1 of '166, but their adjustment by "constructional measures". These measures seem to consist of varying materials and shapes of elements 9, 11 as disclosed in col. 2, lines 30-51 of '166.

12. Claims 10-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Schwerdt, U.S. 5,031,885. The "spring body" comprising connecting arms 4, 5, 6 in '885 is definitely not a "streamlined" body because it does not comply with the definition of streamlined shapes in the subject Application and it has both external and internal sharp corners. Accordingly, any significant preloading is not possible since it would induce high stress concentrations and have a very limited service life. This "spring body" has a rather complex spider-like shape, thus the term "compression" does not apply to deformation of this "spring body". The preloading, applied for reducing undesirable tensile stresses during production, is achieved by dissecting certain parts of the spring body and placing inserts between the segments separated by the dissection.

Applicant believes that these radical differences between '885 Patent and the instant invention preclude using the '885 teachings as a prior art.

13. The following is a translation from German of the phrase in lines 8-4 from the bottom of left column, page 2 of Swiss Patent 196,108, where component 5 is first disclosed:

"Attachment plate 3 of rubber strip 2 is attached to bracket 11 by bolts 5', and attachment plate 4 is attached to end-part 8 of half-axle 9 by bolts 5".

It is clear from this translation that bolts 5 are just fasteners, and 3 and 4 are not preloading shoes but metal end plates for rubber strip 2.

14 Claims 10, 11, 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Japanese Patent JP 60-85918 to Miura, et al, as depicted in Fig. 5 of '918.

JP '918 teaches an injection molding method for rubber-like materials and Fig. 5 illustrates one aspect of an apparatus (injection mold). It is respectfully submitted that the only component moving with the mold is the raw rubber mass pushed by pressure in the injector/extruder.

On the other hand, the subject Application claims a bushing allowing a specified relative motion between two connected mechanical components.

No sleeve 13 as cited in the Office Action is marked in Fig. 5. In Fig. 6, 13 is a thick –walled sleeve, definitely not capable to be deformed for preloading and not interacting with elements 23. These elements, as seen in various views/cross sections in Figs. 5, 2, and 3, cannot be identified as streamlined. Also, presence of rubber structural

elements in a hot mold is not imaginable since these would degrade in a very short time.

15. Kingsley, U.S. 6,082,721, teaches a bushing comprising outer sleeve 21 and inner sleeve 22 (e.g., col. 6, lines 13-20) made of a metal (col. 5, lines 25-27) and an elastomeric interface sleeve 24. These sleeves are assembled with an interference in order to eliminate chemical or adhesive bonding (col. 6, lines 65-67 and col. 7, line 1).

Applicant strongly disagrees with designating sleeve 24 as a "streamlined element" since it is just a cylindrical tubing with an internal spherical recess in its midst.

Applicant could not find a mention of "changing the stiffness ... by preloading" in the cited lines 32-63, col. 6. The stiffness in one or more directions may inadvertently change during the assembly of the three sleeves, but the embodiment and the purpose of '721 and of the instant invention are not even remotely similar.

16. Claim 10 is rejected under 35 U.S.C. 102(b) as anticipated by teachings of U.S. 2,459,741. The '741 patent teaches preloading of specially shaped rubber elements in vibration isolators. The shape of these elements is definitely not one of the streamlined shapes listed in Specification of the instant invention. Accordingly, the functional performance of the bushing of the instant Application (stiffness adjustment in a broad range, up to ten-fold, see three last lines in the published Application (US 2002/0113349, as provided by the Examiner) cannot be and was not achieved in '741. Preloading in '741 resulted in only minimal changes of stiffness of the rubber elements as illustrated in Table of '741 Specification (col. 4, lines 33-42). The maximum difference in stiffness between "not compressed" and "under pre-compression" vibration isolators is from k_1 = 54/0.250 = 216 lb/in to k_2 =47.5/0.250 = 190 lb/in, or only slightly more than 10%, a far cry from the results achievable by using the instant invention.

Adjusting preload of the streamlined rubber elements per the instant invention can change stiffness by at least up to ten times.

17. Claims 9-12 and 14 are rejected under 35 U.S.C. 103(a) as unpatentable over U.S. 3,202,410 or 5,934,653 in view of "any one of the secondary references" 1,734,596 or 1,621,676 or 4,403,784 or 2,459,741.

References '410 and '653 describe applications of streamlined rubber elements in rigid configurations without a possibility of adjusting their characteristics.

The "secondary reference" '741 is addressed above (in Par. 16.); '596 has bolts 37 which do not perform preloading functions, and only performs position adjustment between several components of the design so "that there will be no looseness", page 1, line 90. Clearly, the "fillers" in '596 do not resemble any streamlined shape as defined in the instant specification. The embodiment taught in '676 uses rubber blocks *d* which are restrained by "seats" *a, b, c*. These seats prevent significant deformations of the volumetric incompressible rubber material. The preload applied by bolts *i-m* is applied in order to "maintain this block under internal static pressure", p.1, lines 78-79, not to adjust its stiffness.

No streamlined components are used in '784, the load is applied by bolts 50A and 50B to elastomeric elements 44A and 44B to transmit this compression force to axles 40A and 40B. Elements 44A, B are constrained by their housings and cannot deform, only can serve as force transmitters.

18. The patents '596 and '676 are addressed in Par. 17 above.

19. Claim 10 is rejected under 35 U.S.C. 102(b) as being anticipated by U.S. 5,413,374.

This patent teaches a bushing similar to the Prior Art cited in the instant Application (right side of Fig. 1), but having its outer metal sleeve with a slit which allows the bushing to self-adjust to diameter variation of the aperture into which the bushing should be mounted, e.g. see col. 7, lines 38-49. There is no teaching related to adjusting stiffness values of the bushing.

20. Claim 10 is rejected under 35 U.S.C. 102(b) as being anticipated by U.S. 4,899,997.

Applicant respectfully disagrees with Examiner about element 26 being "streamlined". The meaning of "streamlined" is defined in the instant specification as "radially loaded cylinder of round or elliptical cross section, torus/O-ring, sphere, ellipsoid". Clearly, either half of element 26 in '997, as well as the whole element 26 don't fit this definition.

The "collapsible column elastomeric preload member 42" (col. 5, lines 46-47) "functions to offset radial static deflections of the inner member 13 relative to the sleeve member 24" (col. 5, lines 47-49), not to adjust/change stiffness.

Thus, neither the embodiment nor the functions of "Fluid Filled Resilient Bushing" anticipate teachings of the instant Application.

21. Applicant was unable to find any similarities either in form/design, or in function between U.S. 2,950,102 and the instant Application. Since '102 employs mechanically loaded rubber elements, the rubber elements are supported by metal plates (e.g., 16 in '102), which are basic mechanical design elements, unless their use results in some special performance effects, such as shoes 905 in the instant application. It can be also noted that the metal components 16 and other contacting rubber elements in '102, conform with the rubber surface. However, this is not the case in the instant Application.

22. U.S. 4,109,934 is, presumably, utilizing streamlined (cylindrical) rubber elements in some embodiments of a suspension system. Several critical distinctions between '934 and the instant Application can be listed as follows:

- no stiffness-adjustment preload (one of the basic concepts of the instant Application) is disclosed in '934;
- no bushing connecting two mechanical components is disclosed;
- although the rubber elements look like cylinders in small scale Figs. 1, 2, 4, etc., Fig. 5 and, especially, Figs 24 and 25 which are specific drawings of the rubber elements used, deviate from the streamlined shape.

23. Applicant was unable to find any similarities either in form/design, or in function between U.S. 3,242,877 and the instant Application. Since '877 employs mechanically loaded rubber elements, the rubber elements are supported and contained by metal plates (e.g., 117 and 118 in '877), which are basic mechanical design elements, unless their use results in some special performance effects, such as shoes 905 in the instant application. It can be also noted that the metal components 117 and 118, contacting rubber elements in '877, conform with the rubber elements. However, this is not the case in the instant Application.

24. U.S. 2,910,112 teaches application of a special torsion spring in which four rubber cylinders 32 are placed in four inner corners of metal housing 30 connected to one component and squeezed between said corners and, respectively, four sides of square

cross section bar 26 attached to the other component, thus creating a torsionally compliant connection.

This embodiment is not a bushing as disclosed in the instant application. The rubber cylinders 32 are not loaded in radial compression, but in a unique "squeezing" mode between two rigid surfaces inclined towards each other (flat surface of housing 30 and inclined surface of bar 26), creating totally different stress/strain map than from radial compression, e.g. see col. 2, lines 28-37 of U.S. 4,109,934, one the patents cited in the subject Office Action of 3/26/04, see par. 22 above.

25. Applicant was unable to find any similarities either in form/design, or in function between U.S. 4,244,677 and the instant Application. Since '677 employs mechanically loaded rubber elements, the rubber elements are supported and contained by metal plates (e.g., 42 and 65 in '677), which are basic mechanical design elements, unless their use results in some special performance effects, such as shoes 905 in the instant application. It can be also noted that the metal components 42 and 65, contacting rubber elements in '677, conform with the rubber elements. However, this is not the case in the instant Application.

The preload in '677 is suggested not for stiffness adjustment, but to simplify assembly of the helicopter rotor in the field conditions, as detailed in the cited lines 34-36, col. 3.

26. U.S. 3,897,983 discloses an air bearing in which (Figs. 5, 6) outer housing 21 and bearing sleeve 20 are connected by rubber ring 22. Ring 22 has radial hole accommodating metal insert 25 which can be moved by screw 26 to create local "zone of increased stress in the elastomeric ring 22 adjacent the insert 25", col. 2, lines 30-31. Local stressing in the special radial hole in a rubber ring does not represent radial compression of a streamlined rubber element.

It is known that making holes or other cuts in a streamlined rubber element defeats its advantages by creating a potential for stress concentrations.

27. Applicant was unable to find any similarities either in form/design, or in function between U.S. 5,460,487 and the instant Application. Patent '487 certainly does not disclose a bushing with streamlined rubber elements and means for adjusting its stiffness by means of compressing these streamlined rubber elements. Since '487

employs mechanically loaded rubber elements, the rubber elements are supported and contained by metal plates (e.g., 74a and 82 in Fig. 3a of '487), which are basic mechanical design elements, unless their use results in some special performance effects, such as shoes 905 in the instant application. It can be also noted that the metal components 74a and 82, contacting rubber elements in '487, conform with the rubber elements. However, this is not the case in the instant Application in which the preload-applying shoes are not conforming with the streamlined rubber elements (absent in '487) but applying radial compression to them.

The preload in '487 is applied during the assembly procedure, with a desired stiffness pre-measured. These procedures are described in col. 8, line 41 to col. 9, line 36. No adjustability of the stiffness is disclosed.

28. U.S. 4,859,148 teaches a "Preloaded Tunable Elastomeric Flapping Hinge Bearing and Method of Preloading". The patented device is a bushing whose flexible element is designed as a rubber-metal laminate. This device differs from the "Adjustable Bushing" per instant specification in several aspects.

First of all, while the flexible laminates are preloaded in compression, the bearing bushing as disclosed in '148 does not have means for applying the preload, it is done before the assembly spindle and hub, e.g. col. 3, lines 29-30. After the required amount of axial motion resulting in the required compression preload is determined, the appropriate size (thickness) of shim 80 is selected and inserted as shown in Fig.3, and tightening of bolt 126/nut130 results in the required preload. After this procedure, the preloaded bearing is inserted (assembled) into the spindle/hub unit and the preloading means – bolt 126 and nut 130 are removed, col. 3, lines 67-68 and col.4, lines 1-10. Thus, the bearing in its working conditions does not have the preload means and cannot be considered as an adjustable bushing..

Another critical difference is absence of streamlined rubber elements.

Yet another distinction is the possibility to change stiffness only in one direction in '148, while teachings of the instant application allow to adjust stiffness in more than one direction.

29. U.S. 4,893,412 for "Weapon Sighting Structure" incorporates what is similar to the Prior Art bushing. In no place a mention of a streamlined or, at least, similar shape of

the rubber sleeve could be found. In the contrary, Fig. 1 depicts a rubber flexible element 64 with shapeless ends.

30. Receipt of a copy of the published instant Application is gratefully acknowledged.

31. FR 2676784 teaches a rigid coupling for connecting two mechanical rods/shafts A and B, comprising two sleeves 1 and 2 whose mutual attachment is effected by coordinating axial grooves 1.2 on one sleeve and 2.2 on the other sleeve and filling them by rubber under pressure. Generation of this pressure in each pair of groves, which form complete cylindrical axial cavities, is achieved by inserting into each cavity a cylindrical rubber rod 4 and creating bulging and omnidirectional pressure in these rods by their axial compression applied by screws 8. By doing this, the shafts A and B are reliably connected even if there was an initial small misalignment between them.

Both embodiment and function of this device are totally different from the instant invention. Although rubber rods are cylindrical, they are not preloaded "by compression in radial direction" in order to change their stiffness in a broad range.

32. U.S. 3,494,814 discloses a fabrication method for bushings whose flexible elements are designed as rubber-metal laminated pads configured as spokes. Applicant was unable to find any similarities either in form/design, or in function between '814 and the instant Application. Patent '814 certainly does not disclose a bushing with streamlined rubber elements and means for adjusting its stiffness by means of compressing these streamlined rubber elements.

The preload in '814 is applied during the fabrication process, by swagging the preassembled bushing, e.g. see col. 2, lines 47-52. No adjustability of the stiffness is disclosed.

A similar statement can be made about U.S. 5,033,722. It also employs rubber-metal laminates, not streamlined rubber elements, and the preloading is achieved during the assembly, e.g. col. 5, lines 55-58; no adjustability of the stiffness is disclosed.

Applicant believes that the detailed response to numerous earlier issued patents convincingly illustrates that combining of the "preloading" concept with using streamlined rubber elements as defined in the instant Specification, results in a novel design of bushing having its stiffness adjustable within the range far exceeding all the results previously known.

This performance characteristic of the disclosed "Adjustable Bushing" allows to optimize performance of critical suspension and steering systems of surface vehicles using a simple and inexpensive protocol, while the "Prior Art" requires making a large quantity of slightly different bushings and performing lengthy, ineffective, and expensive "trial and error" process, e.g. see par. 0005 of the published Application US 2002/0113349, as provided by the Examiner. This "trial and error" protocol is universally used presently by all automotive manufacturers and racing teams.

Reconsideration and allowance of the instant Patent Application are, accordingly, respectfully solicited.

Please call on 248.738.5003 with any questions.

Respectfully submitted

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